

WASHINGTON

# SCIENCE TRENDS

HIGHLIGHTS

- \* Air Force Research
- \* Propulsion and Materials
- \* Packaged Switching Circuits
- \* Research Checklist
- \* Publications Checklist

Vol. III No. 4

Oct. 12, 1959

## Air Force Research

Reorganization of the Air Research and Development Command, U.S. Air Force, is now underway. Effects of the change will not be felt for some time. Eventually, it is expected to lead to greater emphasis on development of so-called "in-house" facilities for R&D programs and more extensive control and supervision of industrial and "non-profit" contractors.

- \* Organization: A new Wright Air Development Division will be made responsible for program direction of all aeronautical and related systems. A new Command and Control Development Division at Hanscom Field, Bedford, Mass. will assume direction of all Air Force Communications and electronic control systems. An Air Force Research Division will be established in the Washington, D.C. area from the former Office of Scientific Research and other basic research organizations. No major change will be made in the existing Ballistic Missile Division.

Headquarters, Air Research and Development Command, will remain at Andrews Air Force Base, Md., but will place greater emphasis on long-range planning rather than detailed project supervision -- which will be left to appropriate Divisions. Headquarters will operate six principal sub-divisions: Plans; Research; Engineering; Intelligence; Personnel and Comptroller.

- \* Objectives: Lt. Gen. Bernard A. Schriever says the major objective of the reorganization is to "speed up the clock in introducing new weapons systems - to reduce by a matter of several years the cycle between the initiation of a development until we introduce a system into the inventory..."

The "Principle of Concurrency" -- advocated strongly by Schriever as Commander of the Ballistic Missile Division, is now to be extended to all phases of Air Force Research and Development. Under this controversial system development problems, production problems and logistical and operational problems are tackled at about the same time. Schriever maintains that this saves time and money although it is a "calculated risk" situation. Critics, including Congressional Committees, maintain that this procedure requires research people to "invent on schedule" and the system leads to costly R&D on the production line, rather than in the laboratory.

## ARPA Propulsion and Materials Plans

Advanced Research Projects Agency (ARPA), now moving out of the missile "hardware" field, plans increased emphasis on solid propellant chemistry studies in the coming year. A new program is also being established to speed work on basic materials research.

- \* Solid Propellant Research: ARPA Director Roy Johnson deems "very promising" the \$6 million "integrated" program in the field of solid propellants being carried out under contract by Minnesota Mining and Manufacturing, American Cyanamid, Dow Chemical and Esso Research and Engineering.

These studies combine in a single contract such facets as thermochemistry, thermodynamics and performance estimates; chemical studies aimed at the synthesis of new ingredients; propellant formulation and compounding and the studies of the properties of the final propellant. Prospects are that each of these projects will be supported at somewhat higher monetary levels over the next year.

Supporting Research: Projects being carried out through approximately 50 contracts will continue at roughly the same level. These contracts cover propellant performance, specialized synthesis, ingredients research, high temperature research and special problems.

Non-Destructive Testing: ARPA hopes to complete negotiations in the next two months on a contract with the Jet Propulsion Laboratory, California, for studies of non-destructive testing, at about the \$1 million level. This program is expected to reflect the increasing demands being placed on the mechanical properties of the solid propellants. Among other things, failure criteria are to be developed, as well as instrumentation for the detection of faults.

Combustion Study: ARPA is currently negotiating a contract with a large chemical firm for research on the so-called deflagration-to-detonation phenomena.

- \* Materials Research: ARPA is looking for high-temperature structural materials, super-strength materials for other applications and electronic materials capable of efficient operation at extremely high temperatures. To this end, about 25 universities have been invited to submit proposals, and about 3 to 5 universities will be selected for establishment of materials research laboratories.

Programs: The emphasis at these institutions will be on interdisciplinary research -- bringing together various pertinent scientific and engineering disciplines. Typical projects include phenomena relating to high temperature behavior systems involving gases, energy conversion as related to materials, extreme temperature properties of solids, basic properties of fibers and films, failure-producing phenomena, fundamental surface phenomena, structure of solids, methods of synthesis of new materials, inter-action of radiation and matter, and fundamental inter-action between electrical, magnetic and mechanical properties.

Policy: Johnson asserts that universities will be permitted "great freedom" in defining areas of research work under the new materials program. "We are not working on a crash-type basis," he declares, "and we intend to shield universities from the normal day-to-day problems of weapon system creation. Furthermore, we wish to insure that this basic research work will be continued over long periods of time, to maintain and increase the quality and quantity of facilities, and of the highly-trained staffs involved."

Training: One side-benefit of the new program is expected to be the training of increasing numbers of Ph.D candidates. The laboratories planned for the coming year, and others to be added to the program in 1961, by ARPA and other government agencies, are expected to aid in the training of at least 150-200 new Ph.D's in the materials research area each year.

(For additional information on these programs see SCIENCE TRENDS, July 27, 1959. For general information on ARPA and information on submission of research proposals see SCIENCE TRENDS, June 15, 1959)

\* \* \* \*

#### Packaged Switching Circuits

National Bureau of Standards has developed seven special-purpose transistorized computer packages that perform the logical operations required for electronic data processing. The versatile building blocks can be connected together systematically to accept raw data from experimental equipment for transposition into a form suitable for input to a high speed electronic computer.

Advantages: According to the NBS, each assembly of packages can be tailored to fit the special requirements of a project, and can be used at the site of the experiment. Output can be fed directly to a computer, recorded on a suitable medium for computer input at a later time, or used to drive display equipment which keeps the researcher informed of the progress of his experiment.

Applications: The Bureau found that its own data-handling instrumentation problems could best be met with a series of flexible, logical building blocks to record and perform preliminary processing of much of its data. These blocks can be used where data are produced in large volume; data-taking is extremely fast, extremely slow, or extremely precise; a need exists to minimize human error, tedium and eyestrain; or computation is extensive.

Construction: Each block is compatible with all others and operates at the same 50-kc pulse repetition rate. Each package is constructed on a 4x5 inch plug-in printed board, using stock components. In most of the packages, some components or subassemblies are left unconnected, and must be wired externally to the package -- a process said to permit greater flexibility.

### Research Checklist

- ( ) The Vaporator: Navy has developed a device known as the Vaporator, a small lightweight unit to be used for measuring the vapor source strength of surfaces contaminated by chemical warfare. The device is essentially a two-compartment metal cup, one part of which contains an activated charcoal air filter. Using a rubber bulb, air is drawn at a fixed rate and in the desired volume through the charcoal and over a surface suspected of being contaminated. In this way, according to the Navy, only purified air passes over the sample surface and the test blank is zero. High sensitivity is said to result from a continuous sweeping of the sample surface with a current of air.

(Report to be published in the near future as NRL Report 5361, U.S. Naval Research Laboratory, Washington 25, D.C.)

- ( ) Fast Neutron Detection: An analysis by the National Bureau of Standards indicates that total absorption spectrometers should prove useful in the study of neutron energy spectra, with satisfactory energy resolution and efficiency. Performance was calculated for a flexible fast neutron spectrometer with a boron-10-loaded liquid scintillator.

(Report available. 36 pages. \$1. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for NBS Technical Note No. 10)

- ( ) Space Temperatures: Studies by the Air Force have led to calculations of the equilibrium temperature of an object above the earth's atmosphere. Among the considerations were the height of the object, the shape, the thermal conductivity, heat capacity and -- most important -- the surface absorptivity. Temperatures in the neighborhood of 300°K were predicted for gray bodies. However, a range of 100°K below or above this temperature could result from varying the surface absorptivity.

(Report published as GRD Research Note No. 5, Geophysics Research Directorate, Air Force Cambridge Research Center, Bedford, Mass.)

- ( ) Map Interpretation Tool: Army researchers have developed a map-interpretation tool which is said to quickly and accurately aid in the solution of various problems concerning line of sight between or beyond two points which are on, below or above the earth's surface. The device can be used to eliminate the time-consuming process of drawing earth profiles and is said to have a number of other potential applications.

(Report available. 23 pages. Microfilm, \$2.70. Photocopy, \$4.80. Write Photoduplication Service, Library of Congress, Washington 25, D.C. for Report EP-101, QM Research and Engineering Center)

- ( ) Aircraft Control: National Aeronautics and Space Administration has investigated the possible use of so-called paddle spoilers as a primary lateral control system in aircraft. It has been suggested that these might replace conventional flap-type ailerons which generally require heavy and complex power controls. Wind tunnel and flight tests demonstrated that the paddles work smoothly and effectively at moderate and large deflections, although they were relatively ineffective at small deflections. With improvements, according to NASA, the system might permit large reductions in size and weight of power control systems for certain types of aircraft.

(Report available. Single copies free. Write National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C. Attn: CODE BID, for Technical Note D-32)

- ( ) Midget Flash Unit: U.S. Bureau of Mines has developed a midget photo-flash unit said to be safe for use in coal mines and other explosive atmospheres. The new unit was tested extensively in a methane-air environment. An electrical interlock is said to make the battery-powered internal circuit safe when flash bulbs are removed. A photoelectric cell can be used for remote control applications. No changes are necessary for cameras.

(For further information write Branch of Electrical-Mechanical Testing, Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa.)

- ( ) Fatigue Data Processing: Battelle Memorial Institute, in a program for the Air Force, has developed a new card system for describing and tabulating most information on fatigue for a wide variety of materials. The system is said to be useful for coding on IBM cards information from basic fatigue studies as well as component and structural fatigue data.

(Report available. 195 pages. \$3. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 596)

- ( ) Cloud Height Data Analyzer: Research for the U.S. Weather Bureau has resulted in development of a special computer designed to analyze data received from a ceilometer, or cloud height indicator. The small-scale device will tell an operator what cloud height is present, what the highest, lowest or predominant cloud height was at any time in the last ten minutes, or how often clouds occurred below some critical level during this same period. It is expected that the instrument will relieve trained personnel at airports and weather stations for more important duties by automatically taking the data on a continuing basis, and performing all the necessary calculations.

(Further details available. Free. Write Office of Technical Information, National Bureau of Standards, Washington 25, D.C. for Summary Technical Report - Cloud Height Data Analyzer)

### Publication Checklist

- ( ) Satellites, Lunar Probes and Space Probes, a chart-record of U.S. and Soviet space experiments in summary form up through Vanguard III launched Sept. 18, 1959. 23 pages. Single copies free. (Write Press Office, NASA, 1520 H Street, N.W., Washington 25, D.C. for U.S. and Russian Space Statistics)
- ( ) Weather Control, the final report of a special Advisory Committee. In two volumes. Contains findings and recommendations and detailed technical reports on various phases of weather control. 454 pages. \$2.75 per set. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Pub No. Y 3.Ad 9/6:1/957/V. 1, and 2)
- ( ) Cemented Carbide Technology, an Army Ordnance survey of the technology of cemented carbides for cutting tools. Program is designed to correlate the influence of chemical composition and processing conditions with the resulting physical and mechanical properties of tungsten carbide-based materials. 40 pages. \$1. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Report PB 151 302)
- ( ) Spectrographic Analysis, a Government study made to determine the applications and limitations of solution techniques as a general method of fluorescent x-ray spectrographic analysis. 24 pages. Single copies free. (Write Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigations No. 5497)
- ( ) Atlas-Polaris, a brief report by a Congressional Committee on the progress of the ICBM Programs. 5 pages. Single copies free. (Write Committee on Science and Astronautics, New House Office Bldg., Washington 25, D.C. for Report No. 30)
- ( ) Hydrocarbons, a National Bureau of Standards report designed to provide easy reference to the vapor pressures of a number of hydrocarbons at low temperatures. Some data for the vapor pressures of solid methane, ethane, ethylene, acetylene and cyclopropane are also included. 19 pages. 75 cents. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for NBS Technical Note No.4)
- ( ) Recordings, a report by the Southwest Research Institute on the preservation and storage of sound recordings. Includes information on conventional disc recordings as well as acetate and polyester-based magnetic tapes. 74 pages. 45 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Preservation of Sound Recordings)
- ( ) Nuclear Aircraft, complete transcript of this Summer's Congressional hearings plus translations of various Soviet documents in this field. An invaluable reference aid. 418 pages. Single copies free. (Write Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D.C. for ANP Hearings)
- ( ) Science Teaching Aids, a report which particularly stresses the improvement of Supervisory and Consultant Services in Science and Mathematics. 15 pages. Single copies free. (Write Publications-Inquiry Unit, U.S. Office of Education, Washington 25, D.C. for Cir. No. 581)

